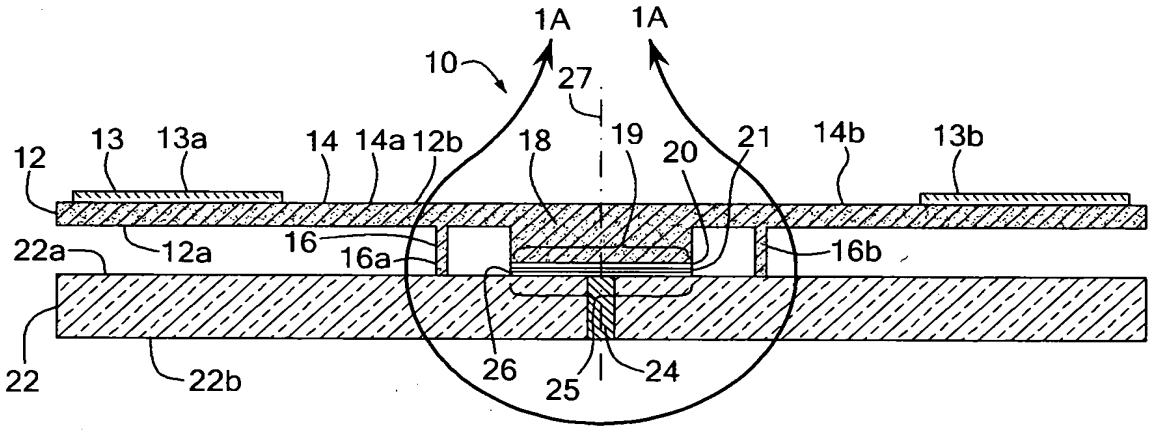


FIG. 1

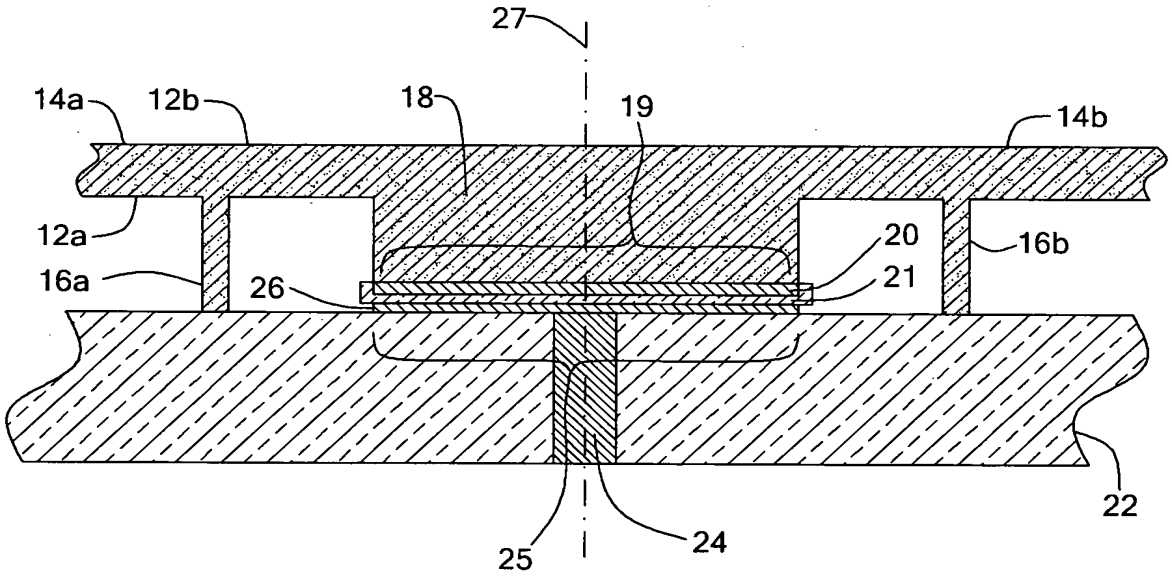


FIG. 1A

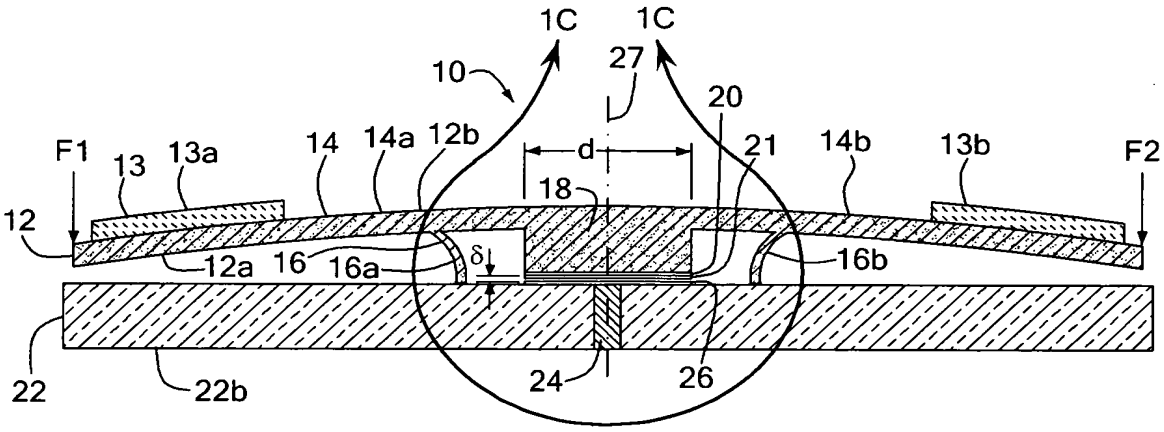

1C
1C
10
27
20
F1
13
13a
14
14a
12b
d
21
14b
13b
F2
18
12
12a
16
16a
δ
16b
22
22b
24
26

FIG. 1B

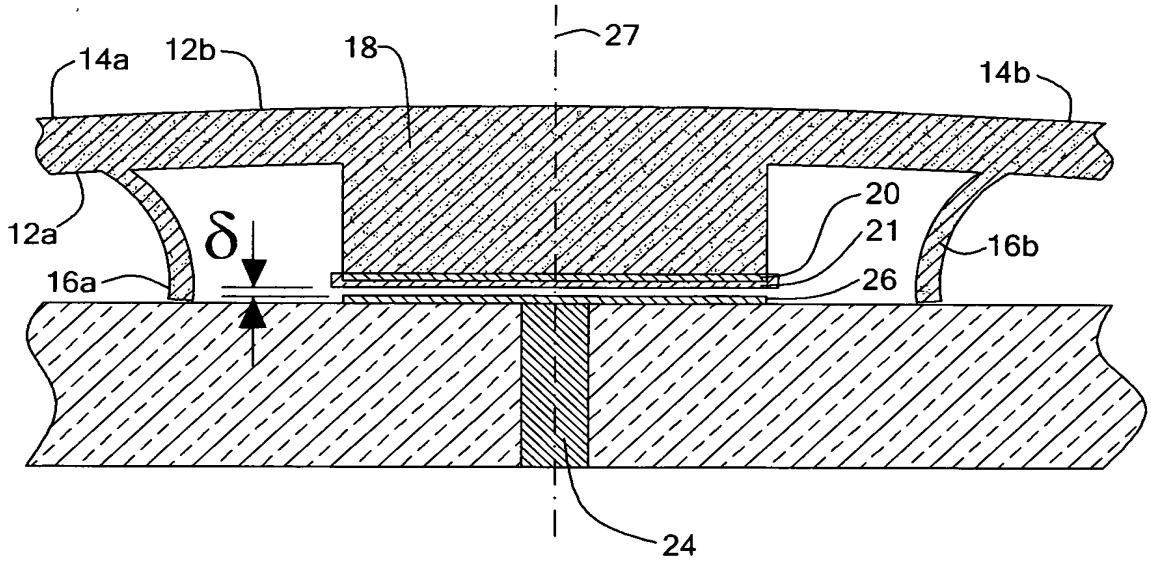

14a
12b
18
27
14b
12a
δ
20
21
16b
16a
26
24

FIG. 1C

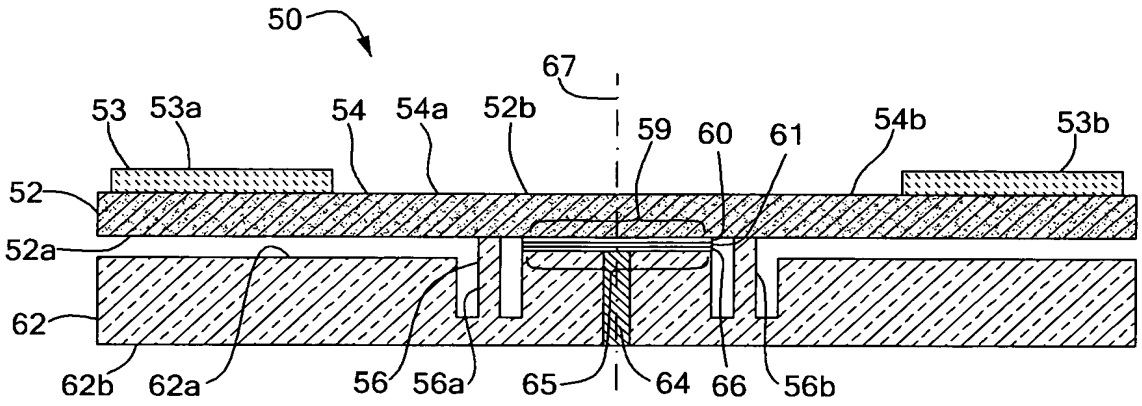

50
67
53
53a
54
54a
52b
59
60
61
54b
53b
52
52a
62
62b
62a
56
56a
65
64
66
56b

FIG. 2

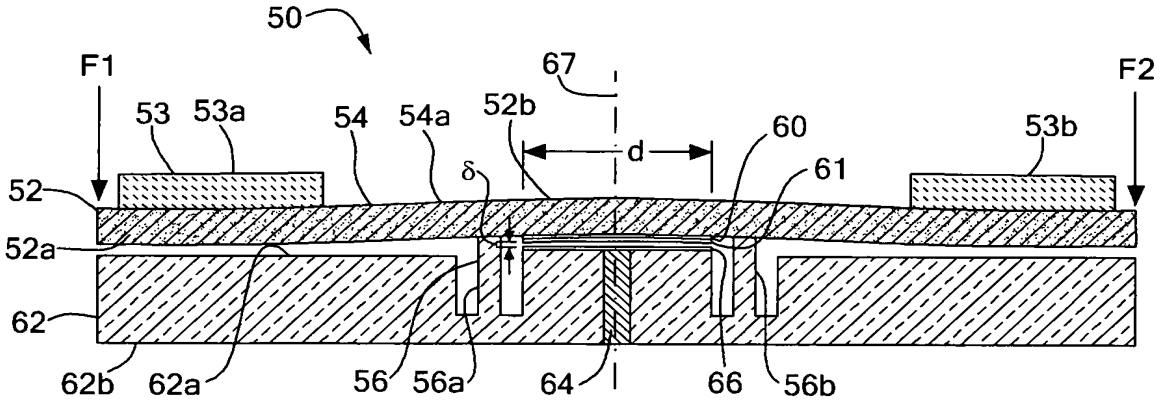

50
F1
67
F2
53
53a
54
54a
52b
d
60
53b
δ
61
52
52a
62
62b
62a
56
56a
64
66
56b

FIG. 2A

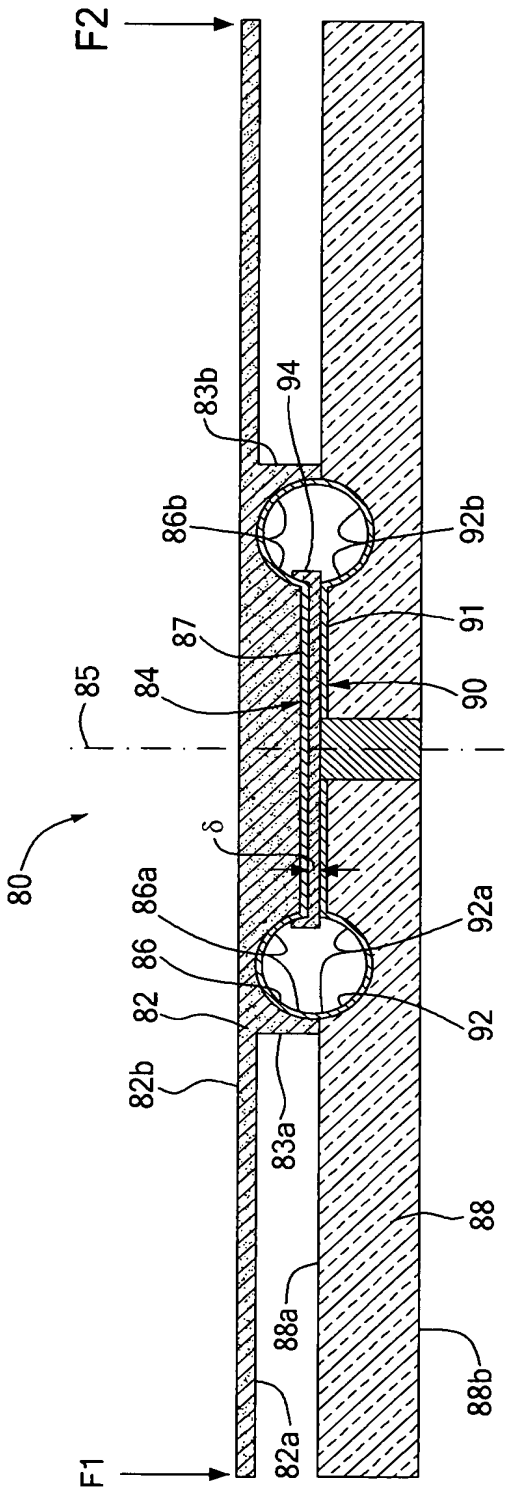

F2
83b
94
86b
92b
91
87
85
84
90
80
δ
86a
92a
86
82
92
82b
83a
88
88a
88b
82a
F1

FIG. 3

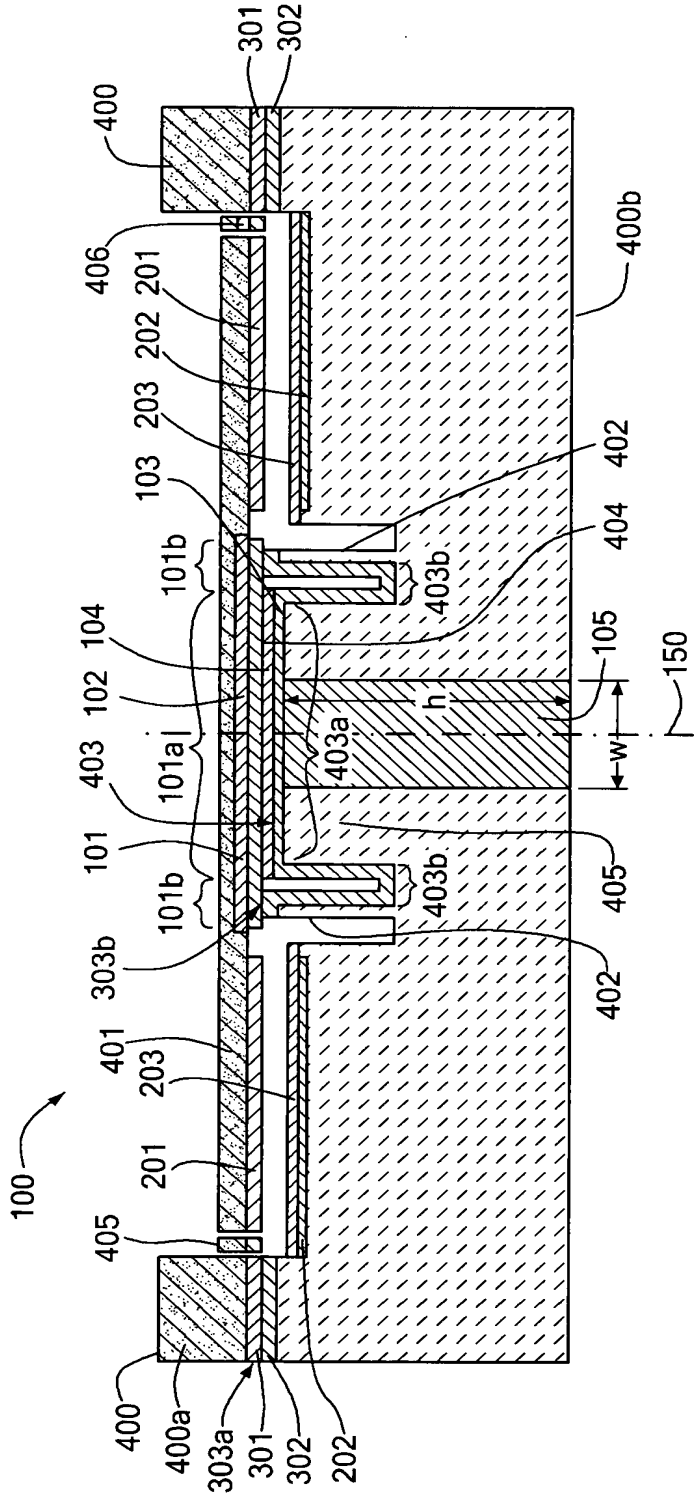

100
101
101a
101b
101b
102
103
104
150
201
201
202
202
203
203
301
301
302
302
303a
303b
400
400
400a
400b
401
402
402
403
403a
403b
403b
404
405
405
406
h
w

FIG. 4

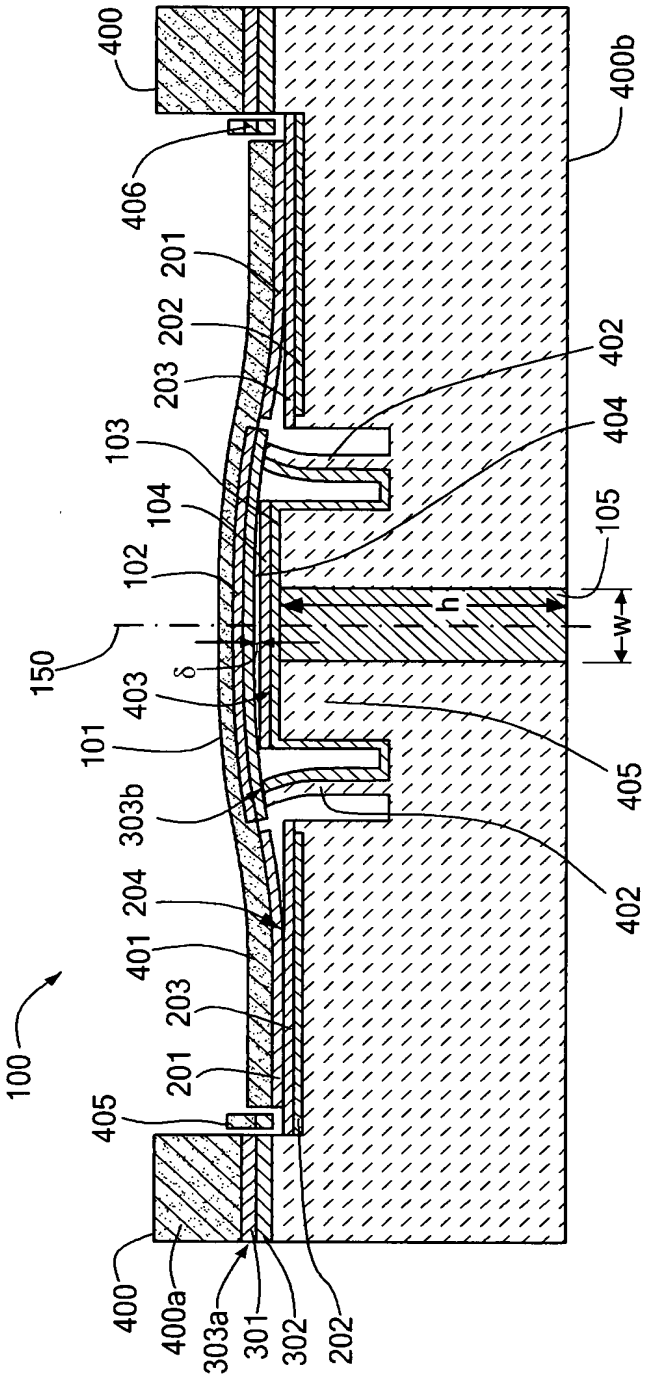

400
400b
406
201
202
203
402
404
103
104
105
102
h
w
150
δ
403
101
405
303b
204
402
401
203
201
100
405
400
400a
303a
301
302
202

FIG. 4A

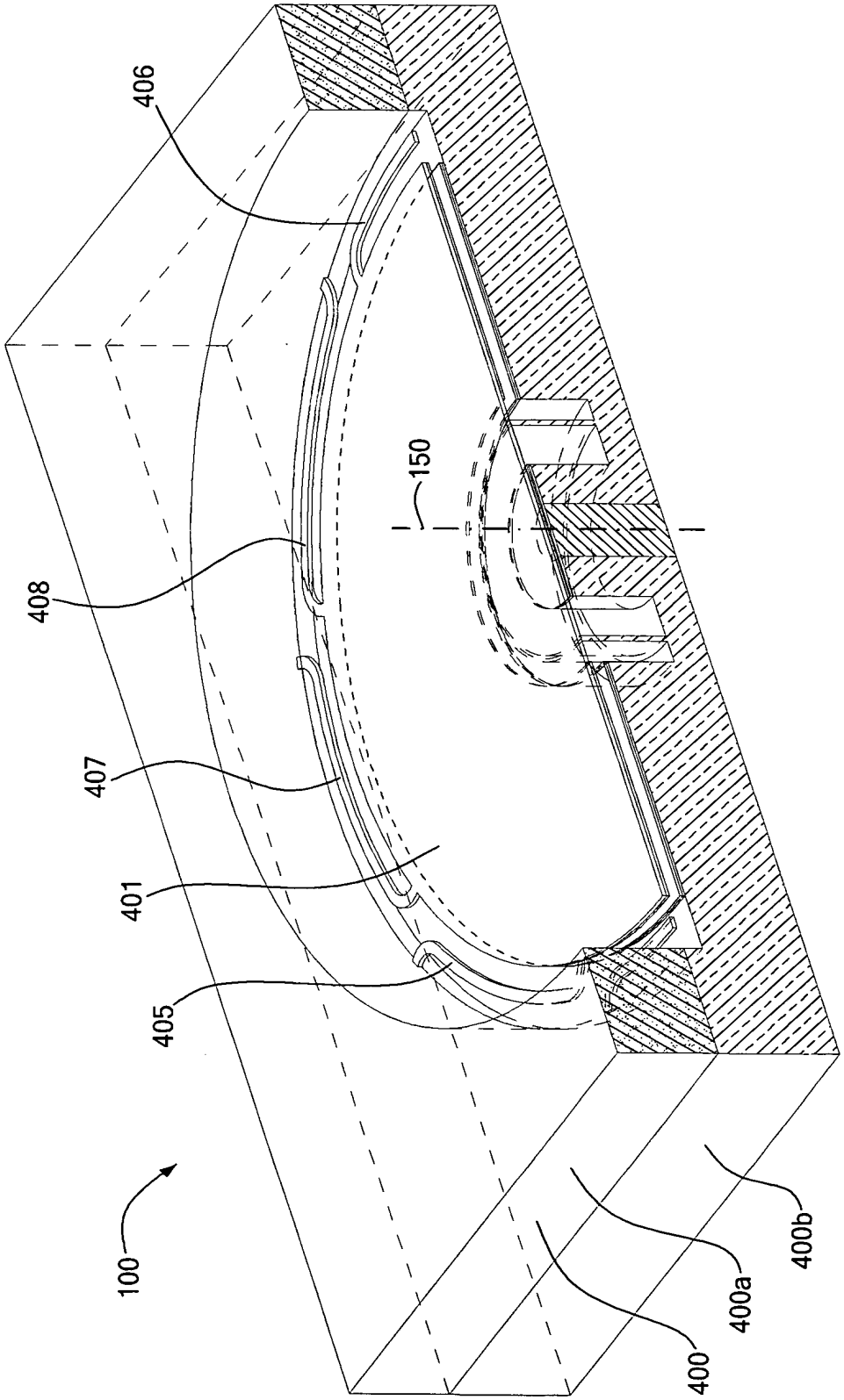


FIG. 5

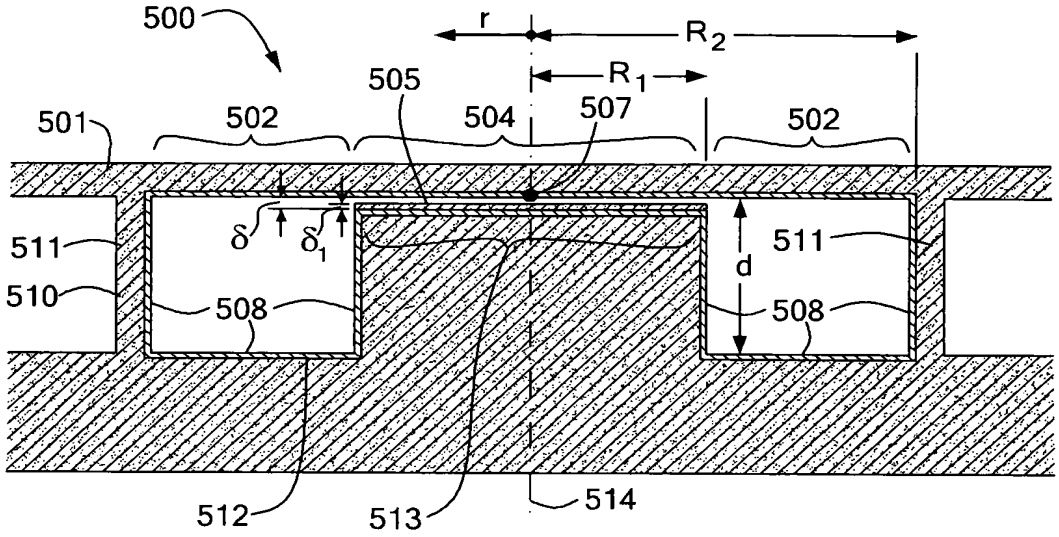


FIG. 6

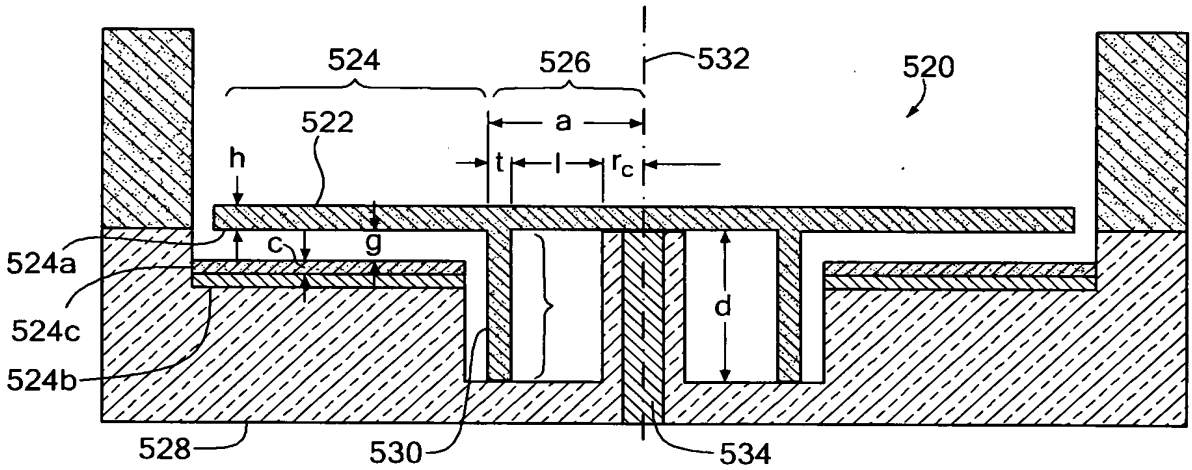


FIG. 7

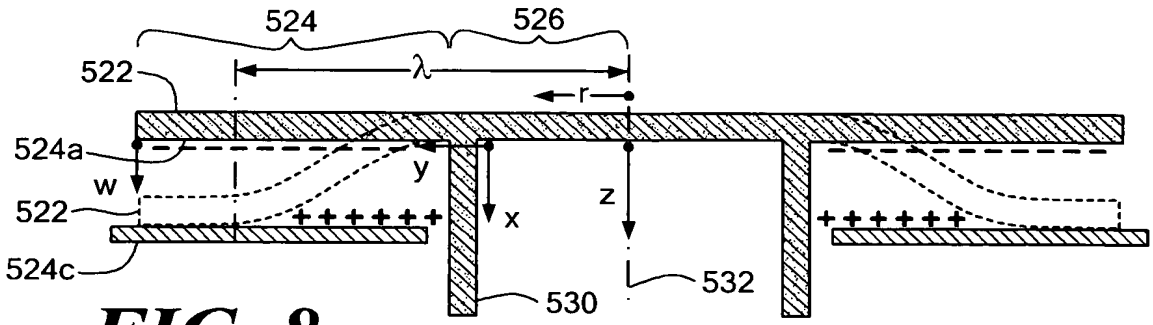


FIG. 8

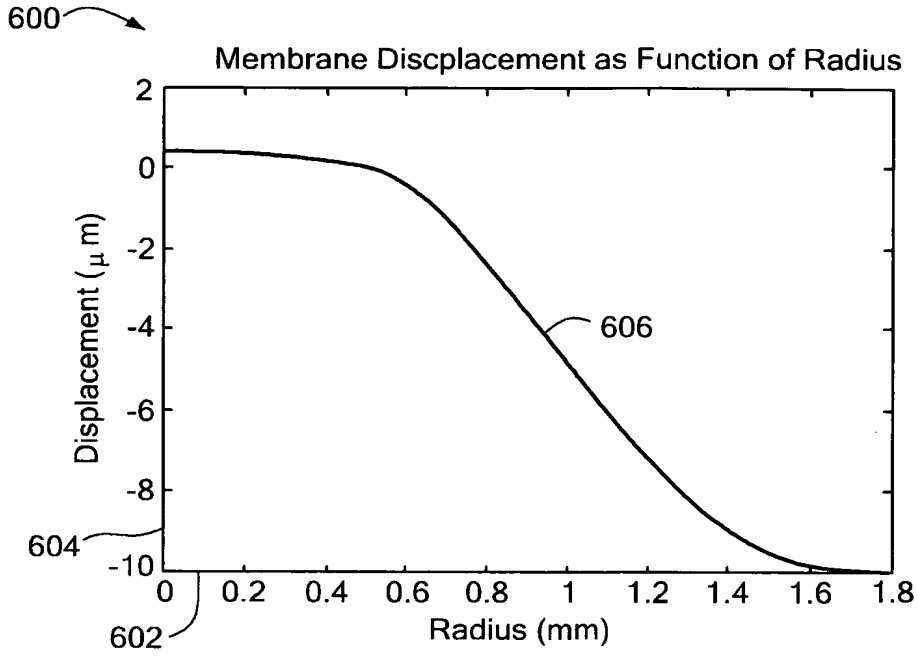

600
Membrane Discplacement as Function of Radius
Displacement (μm)
2
0
-2
-4
-6
-8
-10
606
604
602
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Radius (mm)

FIG. 9

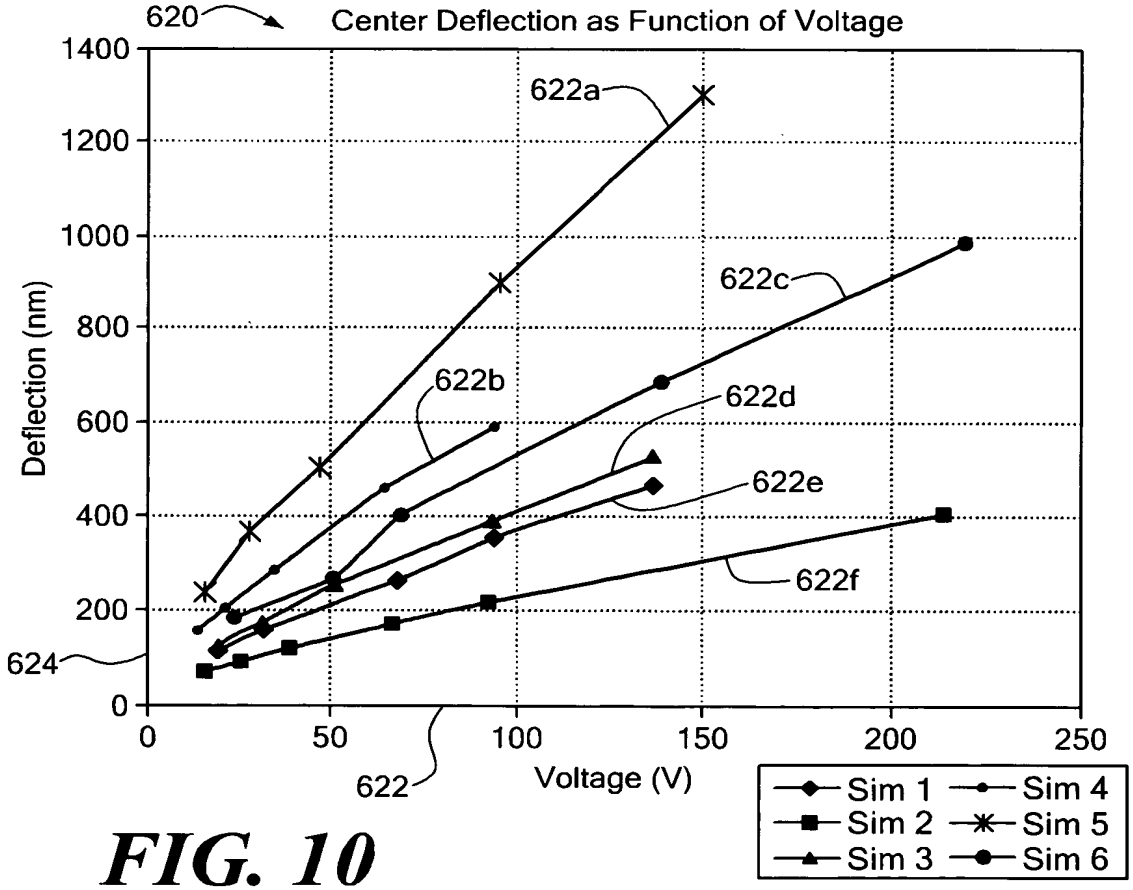

620
Center Deflection as Function of Voltage
Deflection (nm)
1400
1200
1000
800
600
400
200
0
624
622a
622b
622c
622d
622e
622f
622
0
50
100
150
200
250
Voltage (V)
Sim 1
Sim 2
Sim 3
Sim 4
Sim 5
Sim 6

FIG. 10

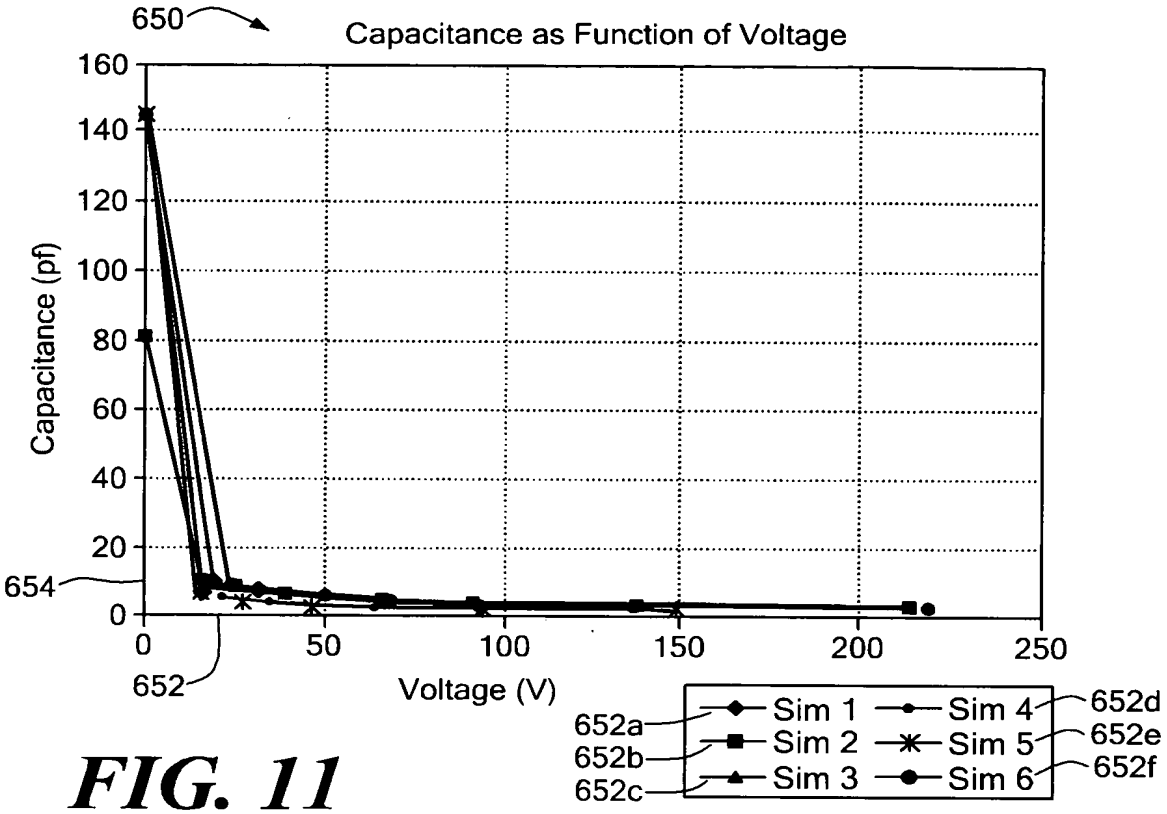

650
Capacitance as Function of Voltage
Capacitance (pf)
160
140
120
100
80
60
40
20
0
654
0
50
100
150
200
250
652
Voltage (V)
652a
652b
652c
Sim 1
Sim 2
Sim 3
Sim 4
Sim 5
Sim 6
652d
652e
652f

FIG. 11

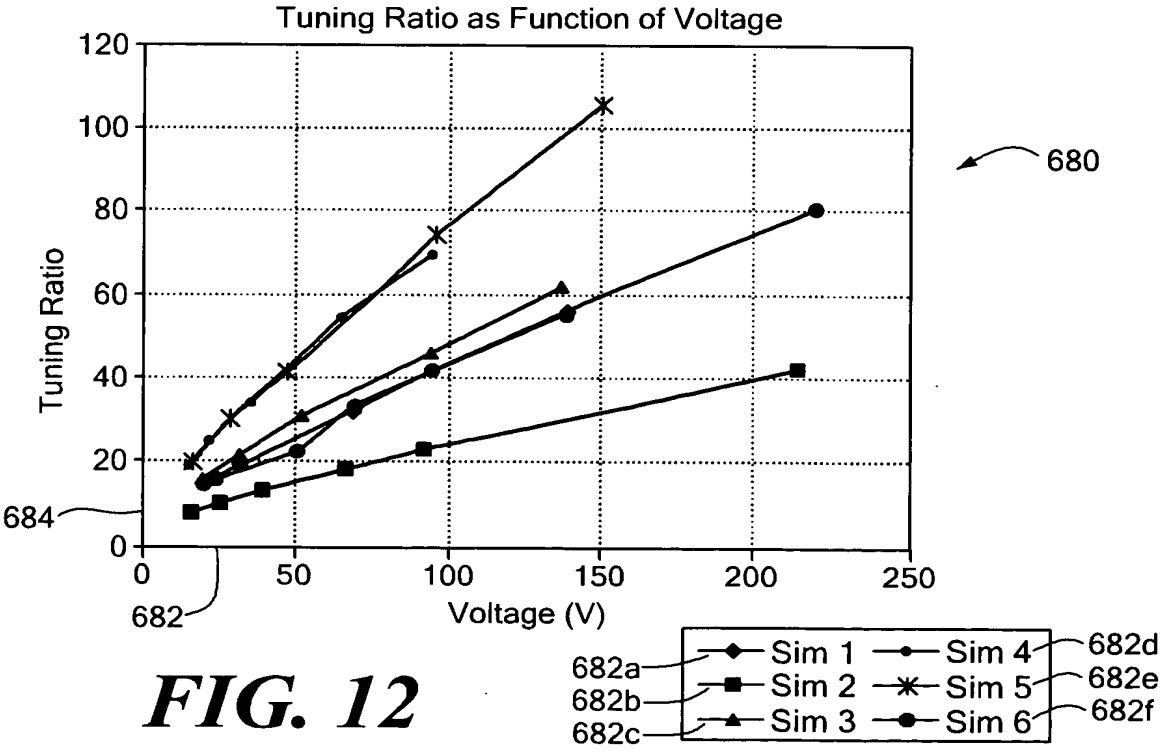

Tuning Ratio as Function of Voltage
Tuning Ratio
120
100
80
60
40
20
0
684
0
50
100
150
200
250
682
Voltage (V)
680
682a
682b
682c
Sim 1
Sim 2
Sim 3
Sim 4
Sim 5
Sim 6
682d
682e
682f

FIG. 12

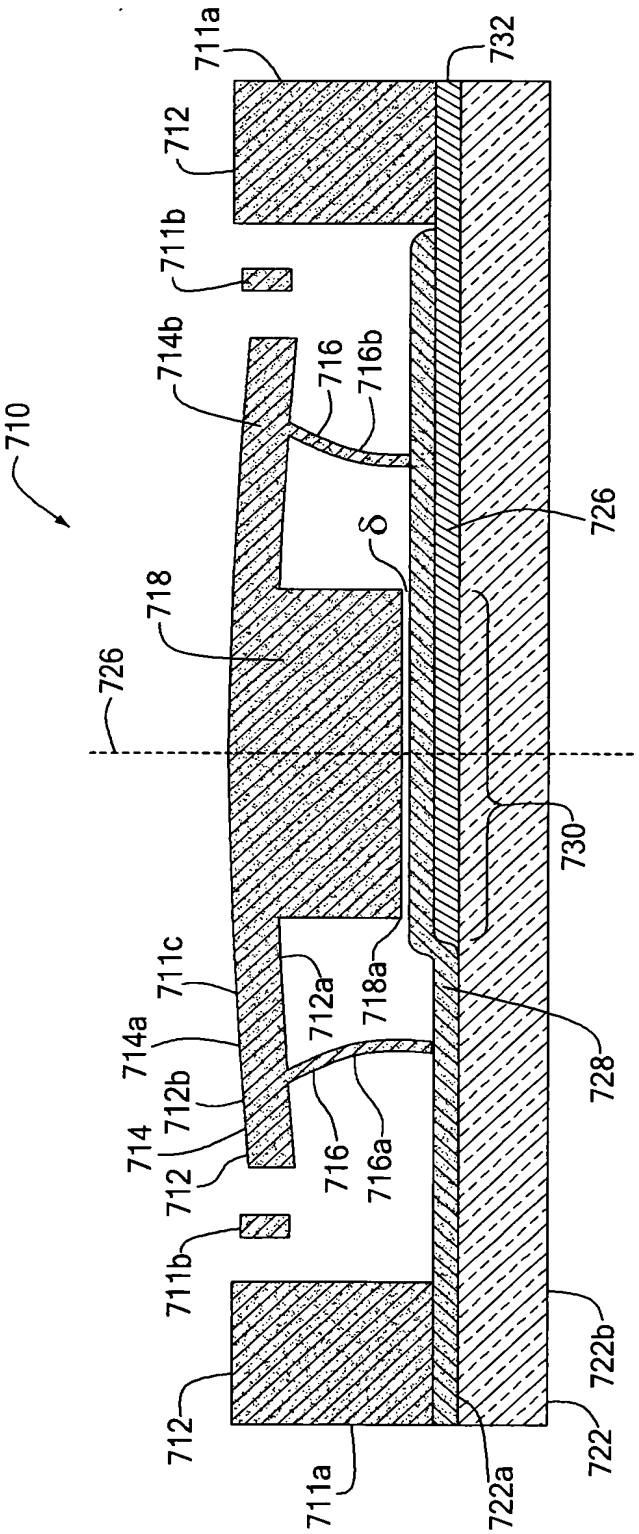

710
711a
712
711b
714b
716
716b
δ
718
726
732
730
711c
712a
718a
714a
712b
714
716a
728
722b
722
722a

FIG. 13

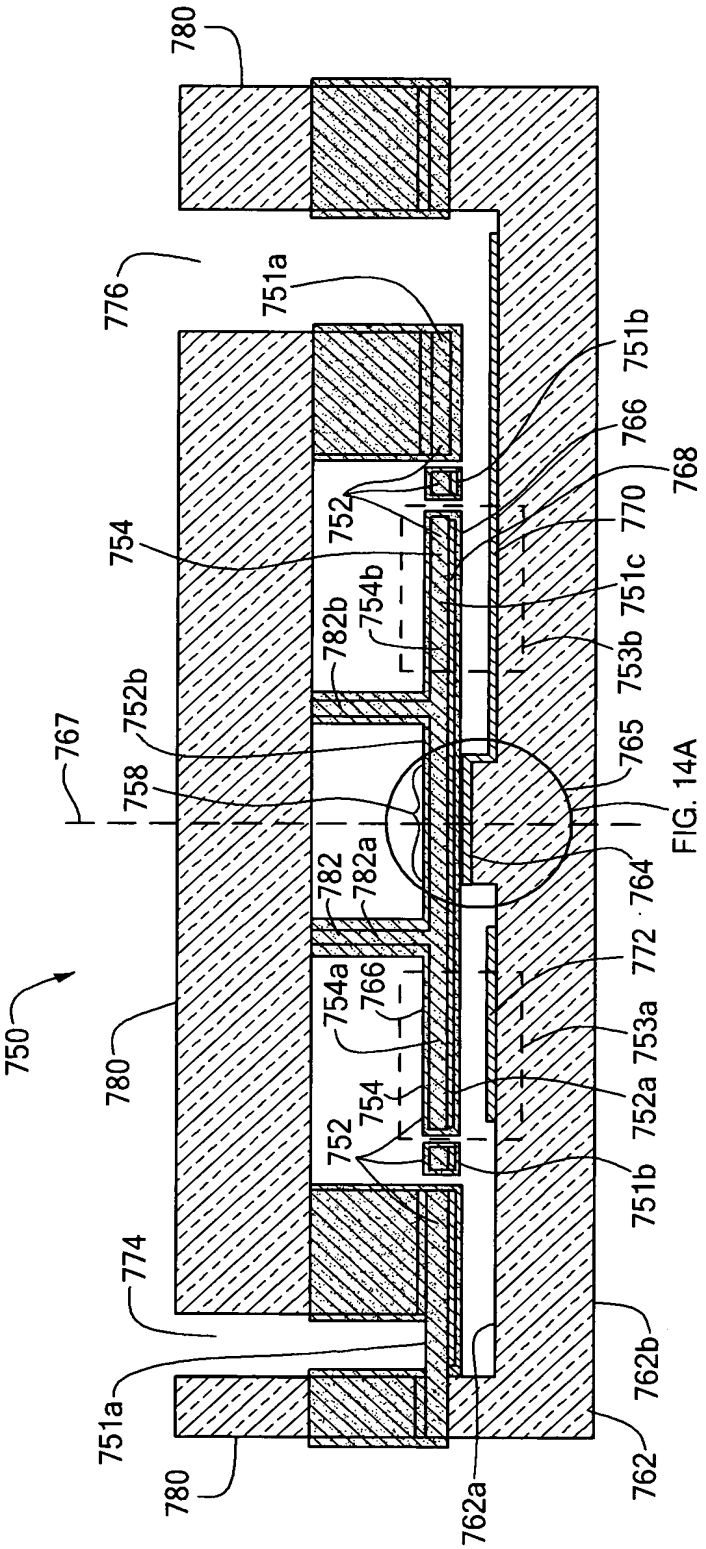


FIG. 14A

FIG. 14

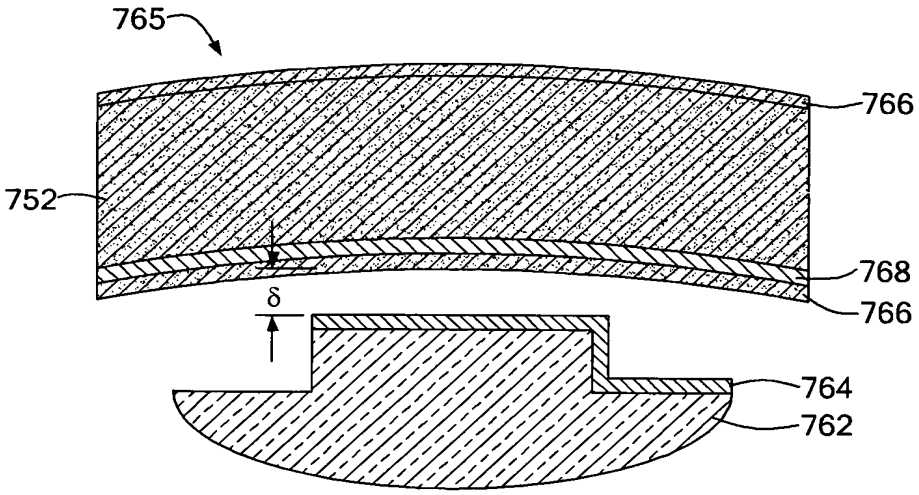


FIG. 14A

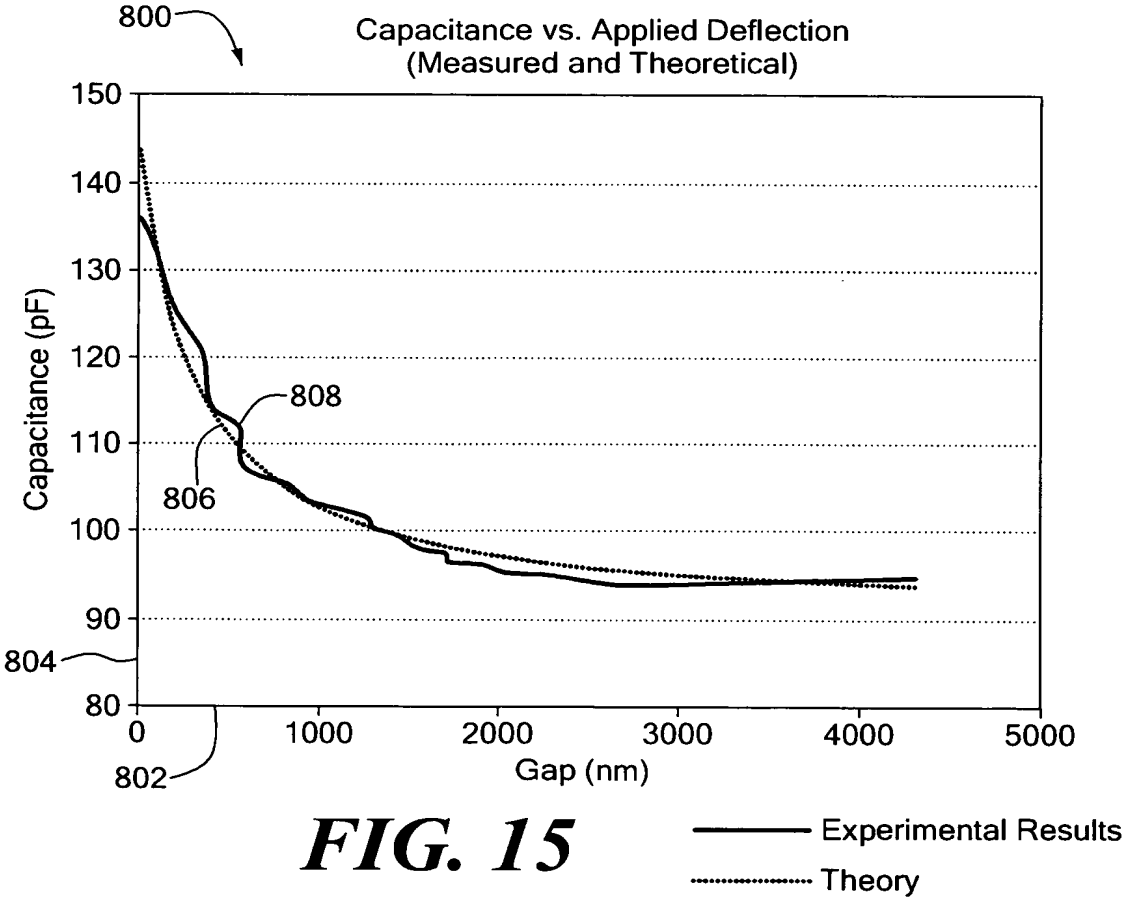


FIG. 15

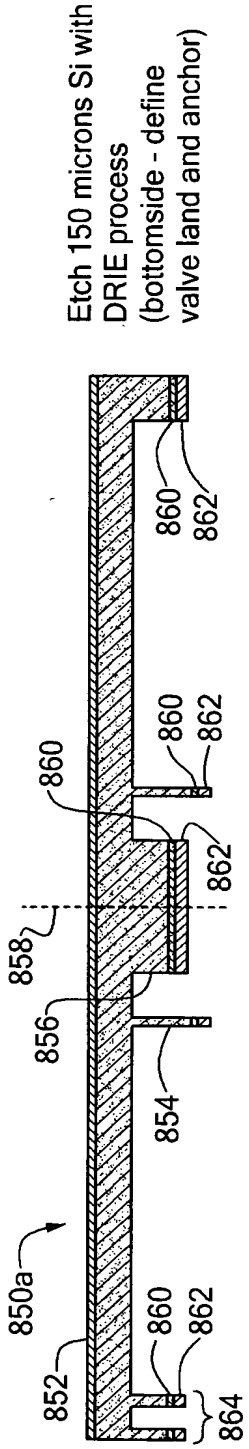


FIG. 16

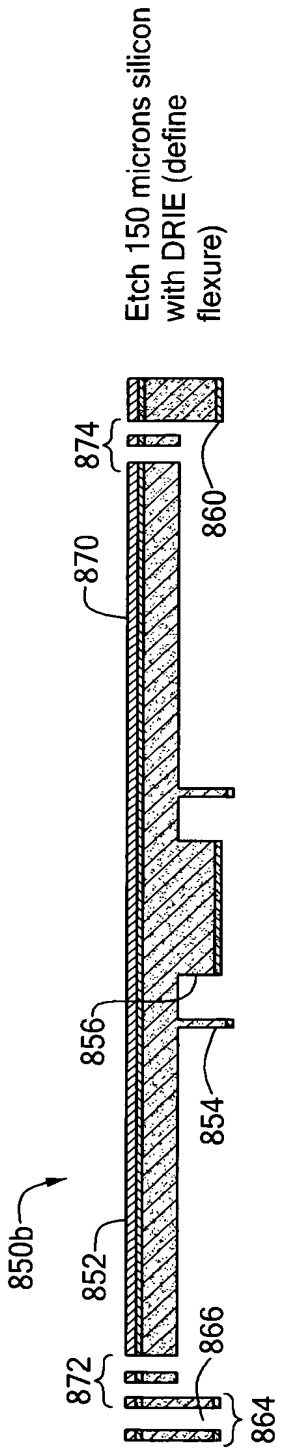


FIG. 16A

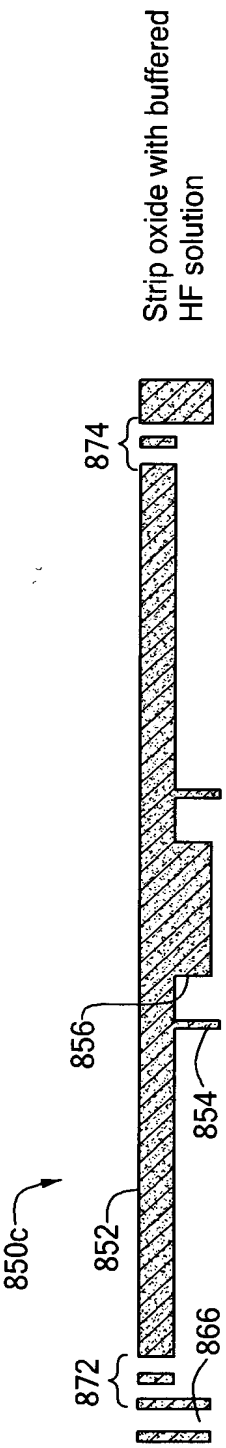


FIG. 16B

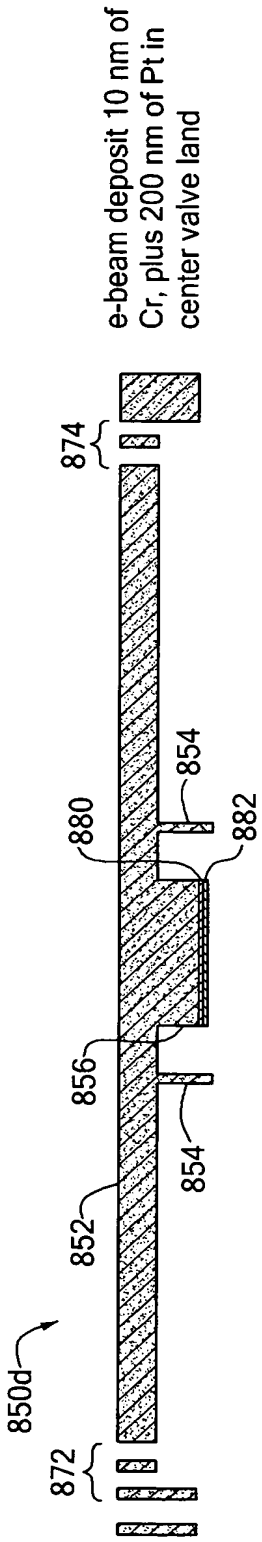


FIG. 16C

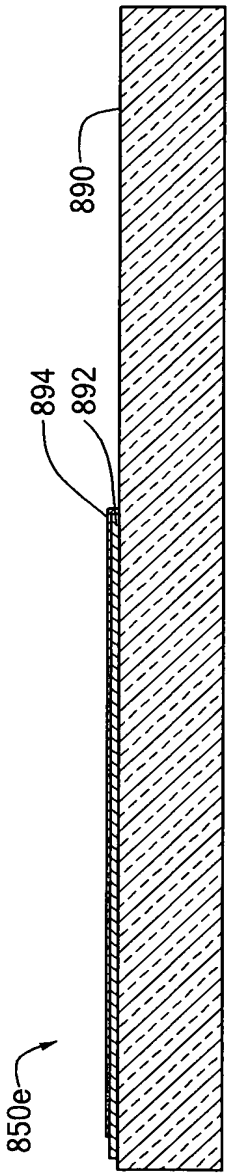


FIG. 16D

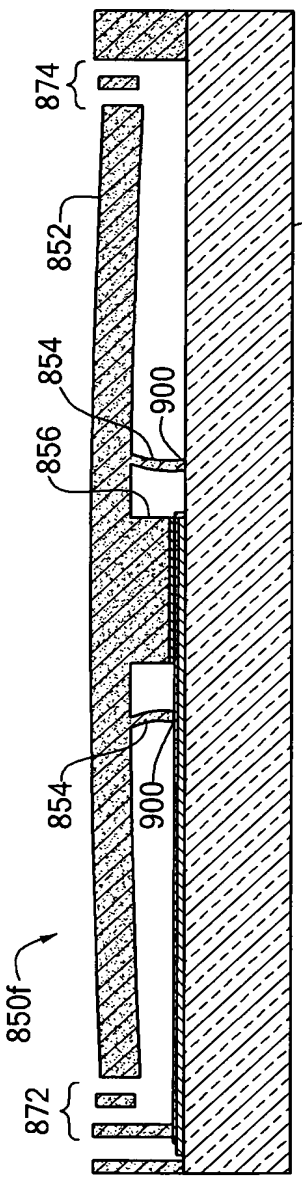
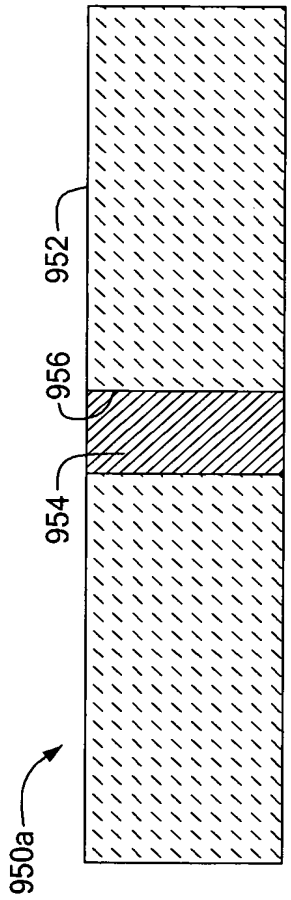
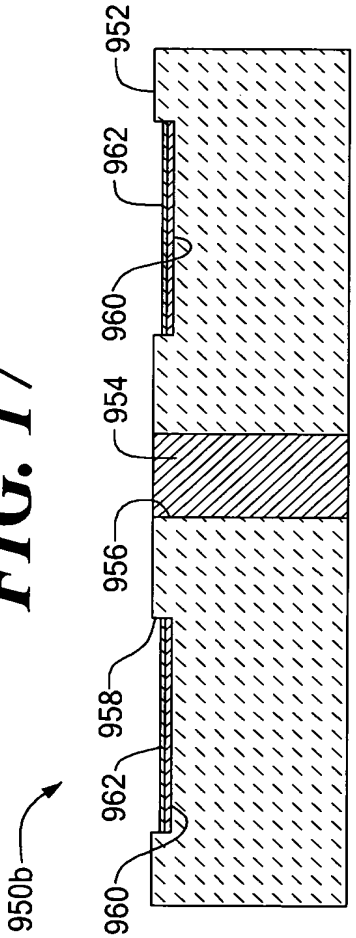


FIG. 16E



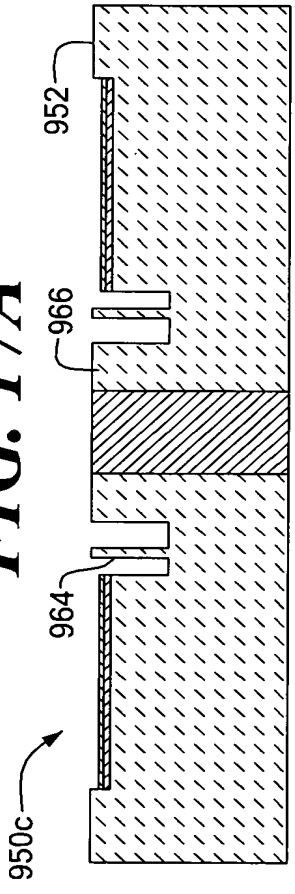
Starting Substrate: Amorphous Quartz
500 microns thick
Ultrasonically drilled vias, backfilled
with gold and CMP polished.

FIG. 17



Wet etch shallow cavity (5 microns), deposit
metal electrode, then grow low-temperature
oxide insulator.

FIG. 17A



Deep RIE (AOE) etch quartz to define
support structure, 100 microns deep.

FIG. 17B

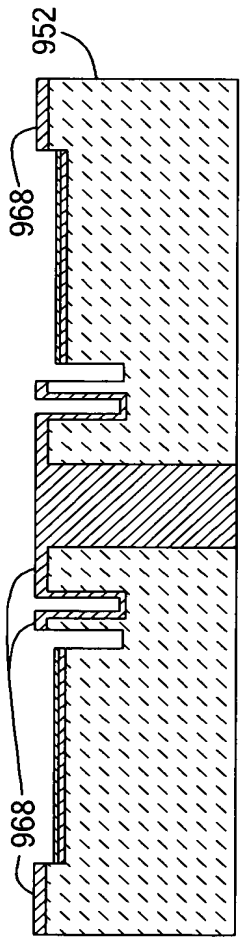


FIG. 17C

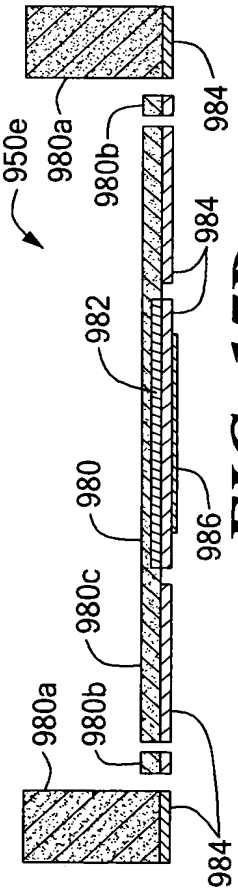


FIG. 17D

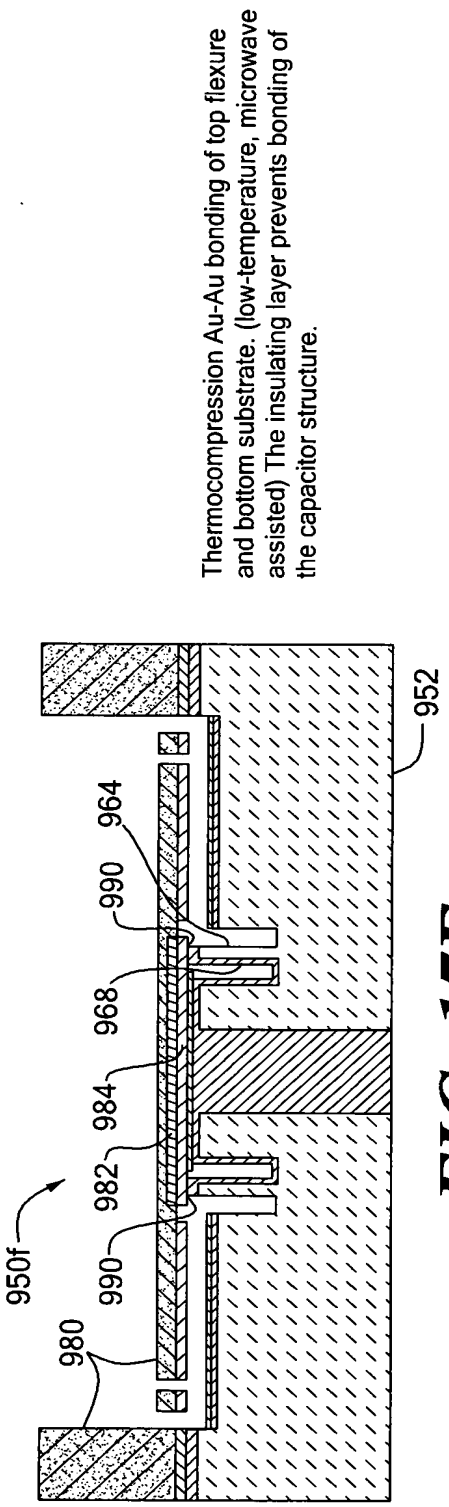


FIG. 17E

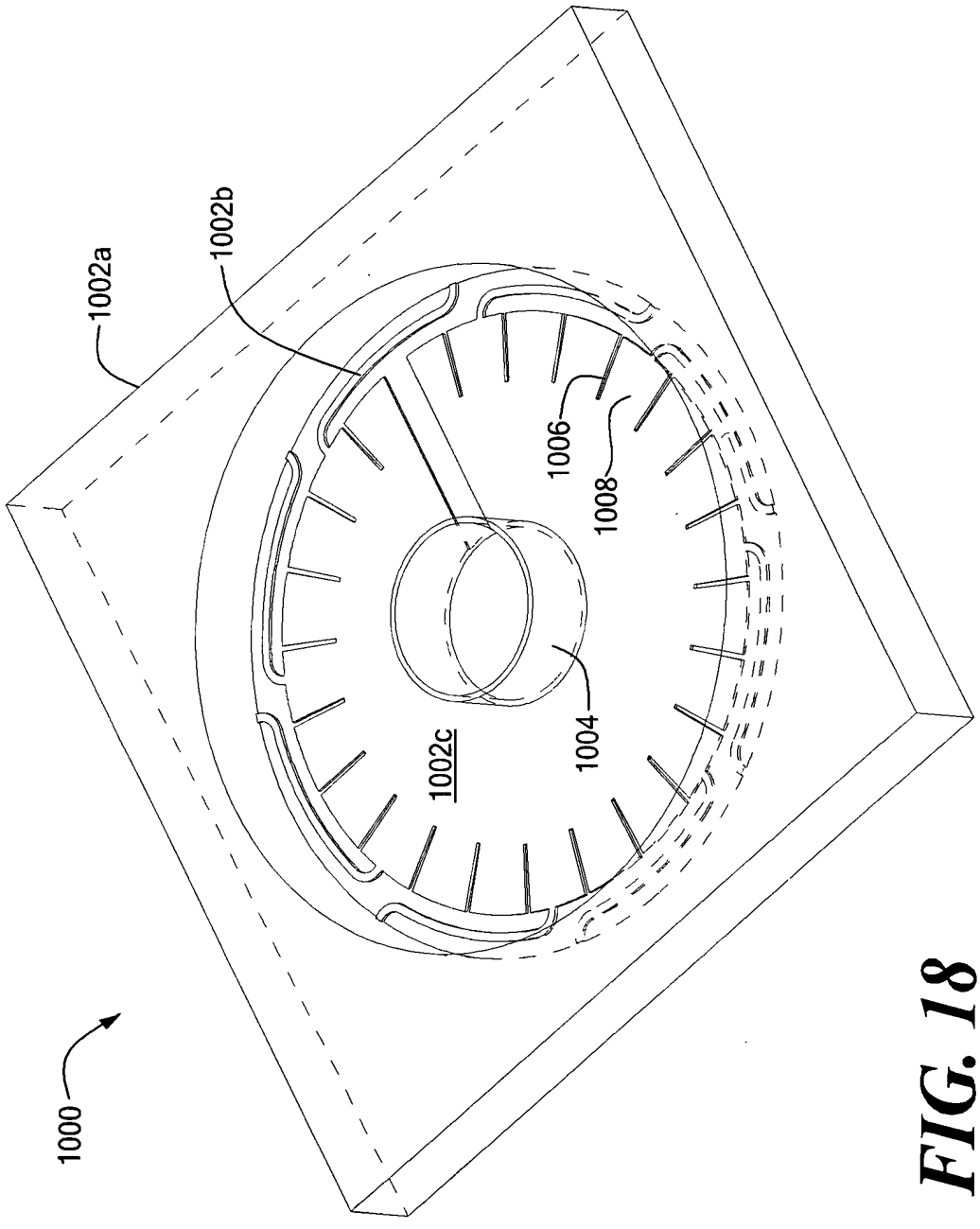


FIG. 18

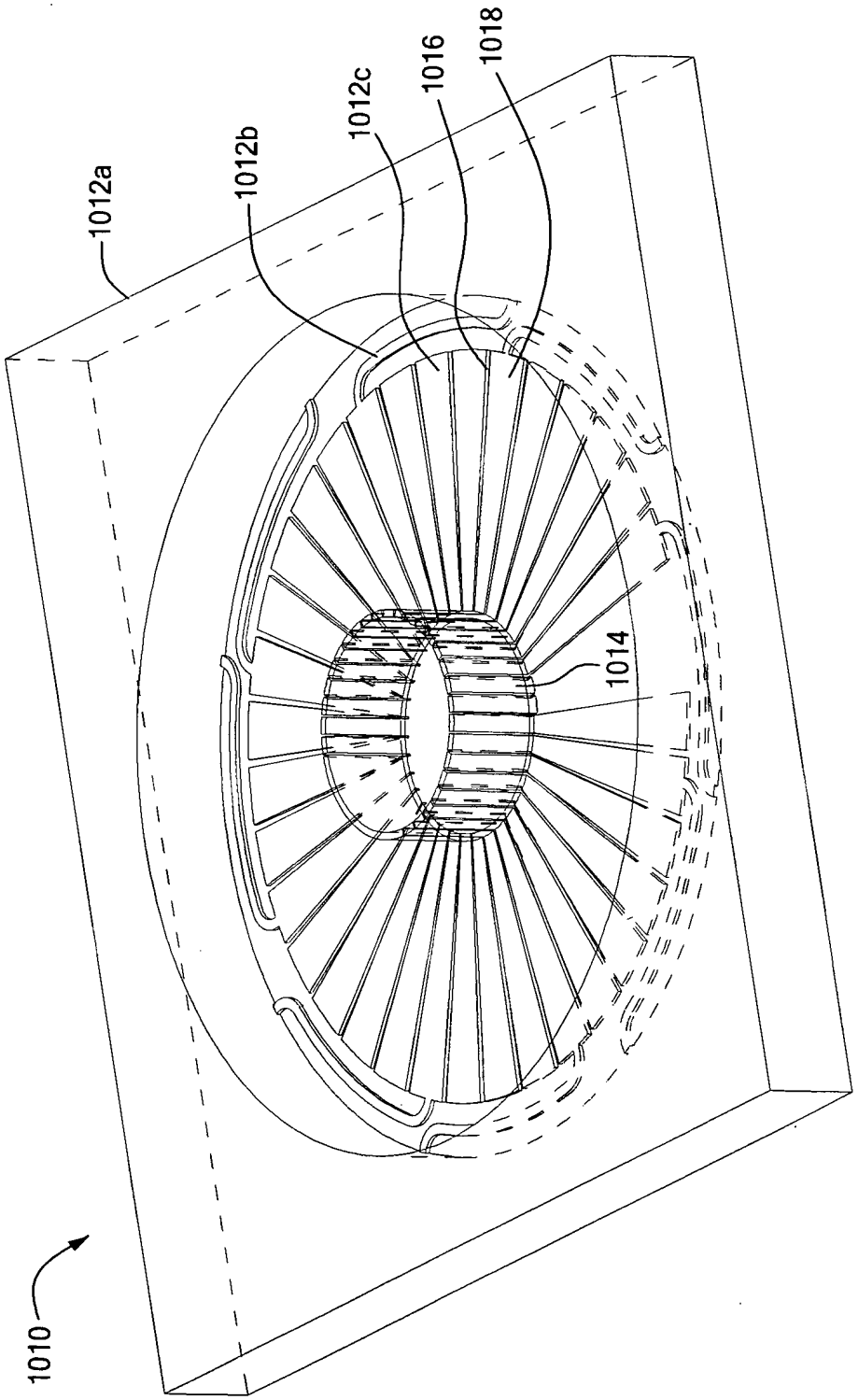


FIG. 19